~~Personal Copy.~~ File Copy

February 4, 1916.

RS
Pi, Insect Control.

INFESTATION IN RELATION TO

INJURY AND DISEASE.

The relation of dying insect-infested trees to injury and disease has been carefully studied in District 5 (California) during the past three years (1913-14-15), with some very interesting results which point to obvious conclusions tending to establish certain methods of Insect Control. The basis of the figures and conclusions reached have been obtained from data collected from trees treated on various forests throughout the State. Certain areas called "Projects" have been worked one, two or three years. The items of injury considered have been fire scars and lightning; those of disease, mistletoe and decay. Although trees of all diameters have been cut and burned, when infested, it is very evident that lightning seldom strikes trees under 12" D.B.H., nor are these trees often subject to decay. Therefore, only trees above 12" D.B.H. are enumerated. Three species of trees have been worked on these areas: yellow pine (Pinus ponderosa), sugar pine (Pinus lambertiana), and Jeffrey pine (Pinus jeffreyi). The sugar and Jeffrey pine have not been sufficient in number to base very definite conclusions. Therefore, this article is based on western yellow pine. The number

Copy sent to the Forester
" " " Dr. M.
" " " Swaine, J. M., Canada.
Copy sent Forester for Bureau of Ent. Mch. 1/1916

F.M.M.

of trees inspected are as follows:

Pinus ponderosa:

1913 - 1616 Trees
1914 - 1857 "
1915 - 648 "

Total - 4121 Trees.

Fire Scarred Trees:*

The percentage of infested fire scarred trees given in Table No. I demonstrate that no particular preference is shown by bark borers for fire scarred trees during second or third year reinfestations of a worked area.

It is true that the Stanislaus and Sierra Forests show a decided increase, but as these areas contained a large amount of new territory the second year they are hardly comparable. The Trinity and California, however, show a slight decrease. Hence it seems a pretty safe conclusion that primary bark borers do not show any decided preference for fire scarred trees. As the number of fire scarred trees on an infested area vary greatly on different parts of the area, this conclusion seems more than ever justified. The table illustrating these differences follows:

Table I:

Percentage of Fire Scarred Trees.	1913	1914	1915
Trinity (Hayfork Project)	29%	25.3%	25%
California (Goodyear Project)	35%	30.2%	-

* This term applies to old fire scar only.

Table I: (Continued)	1913	1914	1915
Stanislaus (Bullock Project)	-	19.2%	37.9%
Sierra (Chiquito Project)	-	17.8%	33.0%

On other projects worked but one year the percentage of fire scarred trees has varied from 16 to 29.5%. Therefore, it does not seem probable that fire scarred trees are any more liable to infestation than trees perfectly sound, the variable percentage depending upon the frequency or severity of local fires.

Lightning Struck Trees:

During the work on the various control projects it has become an axiom with the crew that if a tree was struck by lightning the previous year it was sure to be infested. This preference of bark borers for lightning struck trees is established beyond a doubt not only by personal observations but by the report of every crew and chief of each party. Therefore, the figures in the following table (Table II) show that the lightning struck trees were more or less depending upon the number of trees struck the previous year. The comparative uniformity of the percentages on the several areas worked each year also justify this conclusion.

Table II:

Percentages of Lightning Struck Trees.

	1913	1914	1915
Trinity (Hayfork Project)	2.8%	12.8%	3.3%
California (Goodyear Project)	3.8%	10.4%	-
Stanislaus (Bullock Project)	-	2.0%	0
Sierra (Chiquito Project)	-	14.4%	2.7%

The only exception, the Bullock Project, seems to have been an area not susceptible to lightning.

Decayed Trees:

Table III shows a decided increase in heart rot of worked infested trees for second and third year reinfestations. The increase in percentage of decayed trees is so uniform on the Trinity and so decided on all the others that the data seems sufficient for the unqualified conclusion that bark borers show a preference for these trees as the infestation approaches the normal.

Table III:

Percentage of Decayed Trees.		1913	1914	1915
Trinity	(Hayfork Project)	2.9%	3.8%	4 %
California	(Goodyear Project)	1.7%	4.1%	-
Stanislaus	(Bullock Project)	-	0	10.3%
Sierra	(Chiquito Project)	-	3.4%	16.6%

Mistletoe Infested Trees:

The percentage of mistletoe infested trees killed by bark borers is, with the exception of fire scarred trees, by far the largest and the increase in percentage of such trees on second and third year reinfestations is so great as to leave no doubt whatever as to the preference of primary bark borers for these trees as the epidemic approaches the normal. This is plainly illustrated in Table IV.

Table IV:

Percentage of Mistletoe Infested Trees.		1913	1914	1915
Trinity	(Hayfork Project)	14.7%	25 %	51 %
California	(Goodyear Project)	20.0%	28.1%	-
Stanislaus	(Bullock Project)	-	10.4%	29.3%
Sierra	(Chiquito Project)	-	35.0%	41.5%

Therefore, the only doubtful factor is that of fire scarred trees where it seems pretty safe to conclude:

1. That primary bark borers do not show a preference for fire scarred trees and as far as the purposes of this article are concerned these trees may be included with the sound trees infested:

And evident and conclusive that:

2. Lightning trees are at all times preferred by bark borers.

3. The preference for decayed trees increases as the infestation decreases.

4. The preference for mistletoe infested trees decidedly increases as the infestation approaches the normal.

This preference for diseased and lightning struck trees, (which are at all times undesirable trees in a forest) may be more forcibly shown by comparing the percentages of sound and fire scarred trees, which in uncontrolled epidemics are far in excess of the diseased and lightning struck trees, to the percentages of those which are infested with mistletoe, infected with decay, or struck by lightning. The increase in the percentage of these undesirable trees (in second and third years' work on the same area) which are infested and killed by the various primary bark borers is remarkable.

Table V:

TRINITY NATIONAL FOREST.

	1913		1914		1915	
Sound except for fire scars	641 trees	= 81.0%	279 trees	= 62.5%	150 trees	= 45.2%
Mistletoe, decay & lightning	151 "	= 19.0%	167 "	= 37.5%	182 "	= 54.8%
TOTALS -	792 "	= 100 %	446 "	= 100 %	332 "	= 100 %

SIERRA NATIONAL FOREST.

	1914		1915	
Sound except for fire scars	147 trees	= 50.3%	124 trees	= 48 %
Mistletoe, decay and lightning	145 "	= 49.7%	134 "	= 52 %
TOTALS -	292 "	= 100 %	258 "	= 100 %

CALIFORNIA NATIONAL FOREST.

	1913		1914	
Sound except for fire scars	177 trees	= 75 %	58 trees	= 60.4%
Mistletoe, decay and lightning	59 "	= 25 %	38 "	= 39.6%
TOTALS -	236 "	= 100 %	96 "	= 100 %

Note: The large proportion of new area worked on the Stanislaus in 1915 makes this project not comparable in this table and therefore is not included.

The above table not only shows that as the infestation decreases from epidemic toward normal the sound and desirable trees become more and more exempt from attack; but that continued working of an infestation not only decreases the infestation but removes undesirable trees, and is therefore a sanitary measure aside from that of insect control.

Taking into consideration all the factors herein considered, wholly aside from that of whether infestations after one or two years' control work will, or will not, again increase and become epidemic, it logically seems that from a Silvicultural standpoint infestations should be worked until reduced to the minimum.

I know this is contrary to the present policy. It is here presented as one of the factors which may ultimately lead us to change that policy, providing other investigations now being conducted tend to strengthen these conclusions.

Ralph Hopping.

National Forest Examiner.

RHDW

F. M. M.